#8. 2876 0410 0500 9-5-02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Applicants	:	Constantine Tsikos et al.
Application Serial No.:		10/067,140
Filing Date	:	February 4, 2002
Title:	:	PLANAR LED-BASED ILLUMINATION ARRAY (PLIA) CHIPS
Examiner	:	not yet assigned
Group Art Unit	:	2876
Attorney Docket No.	:	108-127USANB0

Honorable Commissioner of Patents
and Trademarks
Washington, DC 20231

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. 1.97

Sir:

In order to fulfill Applicants' continuing obligation of candor and good faith as set forth in 37 C.F.R. 1.56, Applicants submit herewith an Information Disclosure Statement prepared in accordance with 37 C.F.R Sections 1.97, 1.98 and 1.99.

The disclosures enclosed herewith are as follows:

U.S. PUBLICATIONS

NUMBER	FILING DATE	TITLE
6,398,112 B1	March 31, 2000	APPARATUS AND METHOD FOR READING INDICIA USING CHARGE COUPLED DEVICE AND SCANNING LASER BEAM TECHNOLOGY
6,385,352 B1	October 26, 1994	SYSTEM AND METHOD FOR READING AND COMPARING TWO-DIMENSIONAL IMAGES
6,340,114 B1	June 12, 1998	IMAGING ENGINE AND METHOD FOR CODE READERS
6,230,975 B1	October 7, 1999	OPTICAL READER WITH ADAPTIVE EXPOSURE CONTROL
6,223,988 B1	October 14, 1997	HAND-HELD BAR CODE READER WITH LASER SCANNING AND 2D IMAGE

		CAPTURE
6,166,770	July 18, 1998	CAMERA FOCUS CONTROL ACCORDING TO EXTRACTION RANGE SIZE AND/OR ZOOM RATE
6,099,156	August 7, 1998	THIN LIGHT MANAGING SYSTEM FOR DIRECTING AND DISTRIBUTING LIGHT FROM ONE OR MORE LIGHT SOIURCES AND METHOD FOR MAKING OPTICS STRUCTURES FORE USE IN THE SYSTEM
Re: 36,528	March 24, 1995	OPTICAL SCANNING HEAD
5,988,506	June 16, 1996	SYSTEM AND METHOD FOR READING AND DECODING TWO DIMENSIONAL CODES OF HIGH DENSITY
5,986,745	March 24, 1997	CO-PLANAR ELECTOMAGNETIC PROFILE SCANNER
5,859,418	January 25, 1996	CCD-BASED BAR CODE SCANNER WITH OPTICAL FUNNEL
5,828,050	October 31, 1997	LIGHT EMITTING LSAER DIODE SCANNER
5,786,582	December 8, 1995	OPTICAL SCANNER FOR READING AND DECODING ONE- AND TWO DIMENSIONAL SYMBOLOGIES AT VARIABLE DEPTHS OF FIELD
5,710,417	June 2, 1995	BAR CODE READER FOR READING BOTH ONE DIMENSIONAL AND TWO DIMENSIONAL SYMBOLOGIES WITH PROGRAMMABLE RESOLUTION
5,672,858	June 30, 1994	APPARATUS AND METHOD FOR READING INDICIA USING CHARGE COUPLED DEVICE AND SCANNING LASER BEAM TECHNOLOGY
5,621,203	June 30, 1994	METHOD AND APPARATUS FOR READING TWO-DIMENSIONAL BAR CODE SYMBOLS WITH AN ELONGATED LASER LINE

5,615,003	November 29, 1994	ELECTROMAGNETIC PROFILE SCANNER
5,532,467	00/00/00	OPTICAL SCANNING HEAD
5,378,883	July 19, 1991	OMNIDIRECTIONAL WIDE-RANGE HAND HELD BAR CODE READER
5,319,185	July 24, 1992	SMALL-SIZE HAND-SUPPORTED BAR CODE READER
5,319,181	March 16, 1992	METHOD AND APPARATUS FOR DECODING TWO-DIMENSIONAL BAR CODE USING CCD/CMD CAMERA
5,296,690	September 26, 1991	SYSTEM FOR LOCATING AND DETERMINING THE ORIENTATION OF BAR CODES IN A TWO-DIMENSINAL IMAGE
5,212,390	May 4, 1992	LEAD INSPECTION METHOD USING A PLANE OF LIGHT FOR PRODUCING REFLECTED LEAD IMAGES
5,192,856	November 19, 1990	AUTO FOCUSING BAR CODE READER
5,136,145	August 28, 1990	SYMBOL READER
4,979,815	February 17, 1989	LASER RANGE IMAGING SYSTEM BASED ON PROJECTIVE GEOMETRY
4,900,907	March 18, 1987	OPTICAL INFORMATION READING APPARATUS
4,826,299	January 30, 1987	LINEAR DEIVERGING LENS
4,687,325	March 28, 1985	THREE-DIMENSIONAL RANGE CAMERA
4,570,057	August 6, 1984	INSTANT PORTABLE BAR CODE READER
3,914,596	July 24, 1974	INDUSTRIAL AUTOMATION LOCATING AND TRACKING SYSTEM
3,901,597	September 13, 1973	LASER DISTANCE MEASURING DEVICE

FOREIGN PUBLICATIONS

NUMBER	PUBLICATION DATE	TITLE
WO 01/72028 A1	September 27, 2001	COPLANAR CAMERA SCANNING SYSTEM
WO 01/71419 A2	September 27, 2001	LARGE DEPTH OF FIELD LINE SCAN CAMERA
60/190,273	May 29, 2001	COPLANAR CAMERA
WO 99/64980	December 16, 1999	IMAGING ENGINE AND METHOD FOR CODE READERS

TECHNICAL PUBLICATIONS

The product brochure for the "AV3700 Coplanar Illumination Option" by Accu-Sort Systems, Inc., www.accusort.com/products/coplanar.html, 1 page.

The web-based product information for the "Laser Illuminated Viewing and Ranging (LIVAR) System" by Intevac Corporation, http://www.intevac.com/livar_imagery/livar_imagery.html, pages 1-9.

The web-based product information for the "Model 120 LIVAR Short Wave IR Gated Camera" by Intevac, http://www.intevac.com/photonics/products.html, 2001, pages 1-7.

The product brochure for the "IMAGETEAM 4410ESD Hand Held 2D Image Readers for ESD-Sensitive and Clean Room Applications" by Hand Held Products, a division of WelchAllyn, 2001, pages 1-2.

The product brochure for the "IMAGETEAM 3870 Cordless Linear Imager" by Hand Held Products, a division of WelchAllyn, 2001, pages 1-2.

The product brochure for the "IMAGETEAM 3800PDF Hand Held Linear Imager for PDF417" by Hand Held Products, a division of WelchAllyn, 2001, pages 1-2.

The web-based press release for the Lynx: Datalogic Lynx Hand-Held 2D Imager by Datalogic S.p.A., http://www.datalogic.com/press/lynx_e.htm, 05/25/2001, pages 1-2.

The product brochure for the "Lasiris SNF Laser" by StockerYale, pages 1-4.

The web-based product information for the "NCR 7837 Linear Imaging Scanner" by NCR Corporation, www.ner.com/products/hardware/sa_7837.htm, 2001, pages 1-4.

The product brochure for the "AV3700 High Speed CCD Bar Code Reader" by Accu-Sort Corporation, 2001, 1 page.

The product brochure for the "DALSA IT-PA Image Sensors" by Dalsa, Inc., pages 1-14.

The product specification for the "KAF-4202 Series Pixel Full-Frame CCD Image Sensor" by Eastman Kodak Company, 06/29/2000, pages 1-15.

The user manual for the "Piranha CT-P4, CL-P4 High-Speed Line Scan Camera" by Dalsa, Inc., 2000, pages 1-28.

The product brochure for the "ICX085AL Progressive Scan CCD Image Sensor with Square Pixel for B/W Cameras" by Sony Corporation, pages 1-20.

The product brochure for the "ML1XX6 Series Optical Information Systems" by Mitsubishi Electric, 1999, pages 1-4.

The web-based publication entitled "Combo Scanners: Not Your Father's Bar Code Scanner" by IDSystems, Navas, Editor at Large, http://www.idsystems.com/reader/1998_08/com0898.htm, 1998, pages 1-5.

The web-based publication entitled "3-D Sensing" by Papadoupoulos, http://perso.club-internet.fr/dpo/numeerisation 3d, 2001, pages 1-12.

STATEMENT OF PERTINENCE

U.S. Patent No. 6,398,112 B1 to Li et al. discloses a scanning device for reading indicia of differing light reflectivity, including bar code or matrix array symbols, has a single light emitter, such as a laser or light emitting diode, for generating a scanning light beam to visually illuminate sequential portions of the indicia. A sensor, such as a charge coupled or other solid state imaging device, simultaneously detects light reflected from portions of the indicia and generates an electrical signal representative of the spatial intensity variations of the portions of the indicia. The scanning device may also include an ambient light sensor, and a second light emitter for use only in aiming or orienting the scanning device. A photodetector may also be provided to separately detect one symbol virtually simultaneous with the detection of another symbol by the sensor or to provide dual modalities. A method for reading indicia is also provided.

U.S. Patent No. 6,385,352 B1 to Roustaei discloses a system and method for reading a two-dimensional image, and for comparing the two-dimensional image to stored data representative of a known image. The optical scanning device comprises a sensor for capturing the two-dimensional image, which sensor includes an LED array for projecting an emitted light towards the two-dimensional image. The sensor also includes a lens disposed forward of the LED array for focusing the emitted light and thereby framing the two-dimensional image. The sensor further includes an optical assembly for focusing an ambient light reflected from the framed two-

dimensional image. The sensor includes a CMOS (or CCD) detector for detecting the focused ambient light, the CMOS detector including a photodiode array for sensing the focused ambient light and a processor for processing the ambient light to obtain an electrical image signal. The optical scanning device also compresses the electrical image signal. Finally, the optical scanning device decodes the compressed image signal to obtain image data representative of the two-dimensional image. The image data can be compared to the stored data to determine if the two-dimensional image matches the known image.

U.S. Patent No. 6,340,114 B1 to Correa et al. discloses an imaging engine and signal processing devices and methods for reading various kinds of optical codes. The compact structure may include a two dimensional image sensor, apparatus for focusing images at different focal disclosures, an aiming system, a hi-low LED-based beam illumination system and related signal processing circuits.

U.S. Patent No. 6,230,975 B1 to Colley et al. discloses an optical or symbol reader including CMOS circuitry preferably integrated on a single chip. A CMOS optical reader chip comprises a CMOS imaging array having a plurality of pixels each with a dedicated pixel-site circuit. Charge is accumulated at each pixel location transferred upon demand to a common bus. In a preferred embodiment, exposure time of the imaging array is controlled using a feedback loop. One or more exposure control pixels are positioned adjacent to or within the imaging array and receive light along with the imaging array. The charge of the exposure control pixel or pixels is measured against a threshold level, and the amount of time taken to reach the threshold level determines the time exposure of the pixels of the imaging array. CMOS signal processing circuitry is employed which, in combination with the exposure control circuitry, minimizes time-to-read over a large range of light levels, while performing spatially optimal filtering. Clocking cycles and control signals are time-adjusted in accordance with the varying output frequency of the imaging array so as to provide invariant frequency response by the signal processing circuitry. A multi-dimensional CMOS imaging array is also provided having simultaneous pixel exposure with non-destructive readout of the pixel contents.

U.S. Patent No. 6,223,988 B1 to Batterman et al. discloses a hand-held bar code reader which includes a laser scanning module and a two dimensional image sensor and processor for reading a bar code. The laser scanner assists the 2D image processing by providing information on location, type, range, reflectivity, and presence of bar code for 2D reading. Additionally, the 2D image reading operation is improved by using the laser scan as a spotter beam for aiming.

U.S. Patent No. 6,166,770 to Yasuda discloses an image pickup apparatus with a focus detecting device for detecting a state of focus from a picked-up image signal outputted from an image sensor, and an electronic zoom device for electrically magnifying the picked-up image signal. The image pickup apparatus is arranged to control an operation characteristic of the focus detecting device on the basis of the operating state of the electronic zoom device.

U.S. Patent No. 6,099,156 to Jenkins et al. discloses a rear signal lamp of an automotive vehicle comprising a lamp housing and a curved cover lens for enclosing a thin light managing system. The thin light managing system includes a plurality of backlight light-emitting diodes (LEDs) mounted in a light mounting substrate and secured to the lamp housing. A control module operatively connected to the light-emitting diodes (LEDs) for controlling the operation and illumination of the light-emitting diodes. A reflector matrix having a plurality of reflector cones

corresponding to each of the light-emitting diodes in the mounting substrate and a hybrid optics panel having a direct lensing section covering the reflector matrix and light-emitting diodes and a double redirecting light pipe section surrounding the lensing section. A single light-emitting diodes is coupled along spaced apart quadrants of the redirecting light pipe. Each single light-emitting diodes emits light to the respective quadrant of the optics panel which is reflected and redirected from one or more lens facets to illuminate the front surface of the panel. The direct lensing section and redirecting light pipe illuminate distinct area on the curved cover lens.

U.S. Patent No. RE. 36,528 to Roustaei discloses the design for a bar code scanner using the Light Emitting Diode (LED), Optical Scanner assembly and Charge-Coupled Devices (CCD) capable of reading the barcode symbols at the variable distance. An optical passive elements for increasing the depth of field and a method of fabricating the scanning head by mass-production techniques are also disclosed.

U.S. Patent No. 5,988,506 to Schaham et al. discloses a system for reading two dimensional codes as well as regular bar codes. A laser scanner generates a narrow horizontal beam which scans a code by means of a scanning mirror in the vertical direction. This mirror receives the reflected beam and passes it on to the lens array to yield high quality imaging characteristics all across a large field of view angle. The lens array and an auto focusing system produce images of the scanning lines in the sensor plane - a CCD linear array. In the sensor's plane, sub aperture diaphragms generate partially overlapping fields of view from each of the elements of the lens array. The system electronics converts the CCD linear array electrical signals into digital data. A module synthesizes in real-time the partially overlapping line sections of the image signal into an integrated continuous line signal and stores them consecutively in the image memory. A system processor operates an autofocus, as well as code classification and decoding algorithms.

U.S. Patent No. 5,986,745 to Hermary et al. discloses a co-planar system for determining the shape and dimensions of a surface of an object which includes a projector for projecting a spatially coded pattern of radiation, e.g., light, in a selected plane onto the object. The system also includes a receiving device capable of imaging the reflected pattern in the selected plane, and a discriminator for determining which portion of the reflected pattern corresponds to which portion of the projected pattern. By this means, a received signal representing less than the complete reflection from the projected pattern can be correlated with a discrete portion of the scanned object. The object is moved relative to the selected plane and the procedure repeated to obtain enough reliable data to generate a reasonably reliable surface profile. The resulting set of received signals and correlations are used to calculate the shape and dimensions of the object.

U.S. Patent No. 5,859,418 to Li et al. discloses an optical funnel which evenly distributes light from an array of LEDs to a bar code. A support member with a central aperture holds the LEDs. A shroud with an angled reflective interior surface spreads the light from the LEDs to the bar code. The funnel also optically isolates the LEDs from the photodetector in the scanner.

U.S. Patent No. 5,828,050 to Barkan discloses a portable scanning head which emits and receives light from a light-emitting diode to read symbols, such as bar code symbols. The optics within the scanner are operative for focusing a light beam and the view of a light sensor in different planes exteriorly of a scanner housing. Imaging means are provided in the unit for imaging a viewing window. The viewing window has an area smaller than that of the scan spot.

The system can employ an LED as a light source and tolerate the relatively large-sized (on the order of millimeters) scan spot without sacrificing reading performance since the photodiode "sees" only that portion of the scan spot visible through the viewing window.

U.S. Patent No. 5,786,582 to Roustaei et al. discloses an optical device for reading one- and two-dimensional symbologies at variable depths of field, the device including a light source for projecting an emitted light beam towards the two-dimensional image and an optical assembly, or zoom lens, with dual field of view capability for focusing light reflected from the framed symbology onto a CCD detector for detecting the focused light and generating a signal therefrom. The dual field of view capability enables scanning of both wide and narrow fields of view. An apodizing filter is provided within the optical assembly to increase depth of field. Aiming of the sensor to read the symbology is facilitated by a frame locator including a laser diode which emits a beam that is modified by optics, including diffractive optics, to divide the beam into beamlets having a spacing therebetween that expands to match the dimensions of the field of view of the sensor, forming points of light at the target to define the edges of the field of view. One or two sets of diffractive optics may be provided, with one set corresponding to each position, for each of the dual field of view positions of the zoom lens.

U.S. Letters Patent No. 5,710,417 to Joseph et al. discloses hand-held linear images, in which a plurality of the areas of differing light reflectivity of a bar code symbol or the like which are simultaneously illuminated using, for example, a beam of light that has an elongated cross-section. The light beam is swept over the symbol to be read in a direction transverse to the elongated dimension of the illuminated region so that a two-dimensional area of the symbol is illuminated over time. The reflected light is sensed by a 1D CCD array. A microprocessor within the scanner provides visual feedback to aid a user in aligning the device, and also provides for a selectable aspect ratio for the image, a selectable image resolution and size, a selectable aspect ratio of the illumination, and a selectable pixel size. All of these options may be programmed within the microprocessor, enabling the device to read a large variety of two-dimensional symbols.

U.S. Patent No. 5,672,858 to Li et al. discloses a scanning device for reading indicia of differing light reflectivity, including bar code or matrix array symbols, which has a single light emitter, such as a laser or light emitting diode, for generating a scanning light beam to visually illuminate sequential portions of the indicia. A sensor, such as a charge coupled device (CCD) or other solid state imaging device, simultaneously detects light reflected from portions of the indicia and generates an electrical signal representative of the spatial intensity variations of the portions of the indicia. The scanning device may also include an ambient light sensor, and a second light emitter for use only in aiming or orienting the scanning device. A photodetector may also be provided to separately detect one symbol virtually simultaneous with the detection of another symbol by the sensor or to provide dual modalities. A method for reading indicia is also provided.

U.S. Patent No. 5,621,203 to Swartz et al. discloses a plurality of the areas of different light reflectivity of a bar code symbol, or the like, which are simultaneously illuminated using, e.g., a beam of laser light that has an elongated cross-section. The laser light beam is swept over the symbol in a direction transverse to the elongated dimension of the illuminated region so that a two-dimensional area of the symbol is illuminated over time, until the symbol is read. The light that reflects from the illuminated region of the symbol is imaged on a linear sensor array, which is then scanned or read out to produce signals representative of spatial intensity variations of the imaged light along a linear path in the field of view.

U.S. Patent No. 5,615,003 to Hermary et al. discloses a system for determining the shape and dimensions of a surface of an object which includes a projector for projecting onto the object a spatially coded pattern radiation, e.g., light. The system also includes a receiving device capable of imaging the reflected pattern, and a discriminator for determining which portions of the reflected pattern corresponds to which portion of the projected pattern. By this means, a received signal representing less than the complete reflection from the projected pattern can be correlated with a discrete portion of the scanned object. The procedure is repeated to obtain enough reliable data to generate a reasonably reliable surface profile. The resulting set of received signals and correlations are used to calculate the shape and dimensions of the object.

U.S. Patent No. 5,532,467 to Roustaei discloses an optical scanning head which includes at least one trio of light emitting diodes arranged so the LEDs emit light at different angles to create a fan of light. An optical module includes a light shield or "dark room" and a lens/filter assembly which provides control of the depth of focus of the scanner. The optical module is located behind the light source, and the detector, made up of a CCD array is mounted behind the optic module for detecting the light intensity in the reflected beam over a field of view across a bar code symbol. The CCD array generates an electrical signal indicative of the detected light intensity. A DC source or battery provides DC voltage to the LEDs and CCDs in response to a clocked signal which provides a gradual or sequential illumination of the LEDs and coordinates the activation of the CCDs in order to minimize power consumption during scans.

U.S. Patent No. 5,378,883 to Batterman et al. discloses a hand-held bar code reader with a two dimensional image sensor for omnidirectional bar code reading, which includes variable imaging optics, and flash illumination with variable flash illumination optics. A spotter beam is provided for aiming the hand held bar code reader at a bar code symbol. The spotter beam is also used to measure the range to said bar code from said hand held bar code reader and to determine the focal length of said variable imaging optics and variable flash illumination optics. The imaging optics are adjusted automatically to provide the correct magnification and focus of a bar code regardless of range to the label. The variable focal length flash illumination optics are used to concentrate illumination energy only in the field of view of the bar code reader. The flash illumination energy is conserved by measuring the ambient light and setting the level of flash illumination energy in accordance with the measured level of ambient light. In such a manner, conventional, damaged, multiple, and stacked bar code symbols along with true two dimensional codes may be rapidly read over distances from under one foot to over several feet without having to align the bar code reader to the bar code.

U.S. Patent No. 5,319,185 to Obata discloses a bar code reader which has a sensor unit to be mounted on an operator's finger and a decoder unit to be mounted on an operator's wrist, the sensor and decoder units being electrically connected by a cable. The sensor unit has a light-emitting device for emitting light toward a bar code to be read, a graded-index rod lens array for focusing an entire linear optical image of the bar code at one time in substantially the same size as the bar code, and a line image sensor such as a CCD for photoelectrically converting the entire linear optical image focused by the optical means into an electric signal. The decoder unit decodes the electric signal from the line image sensor. The light-emitting device, the rod lens array, and the line image sensor are housed in a hollow casing. A movable tubular member is movably disposed in the hollow casing and has an end wall for abutment against the bar code. A switch for energizing the light-emitting device and the decoder unit is fixedly mounted in the

hollow casing and triggerable by the movable tubular member when the movable tubular member is moved by abutment of the end wall thereof against the bar code.

U.S. Patent No. 5,319,181 to Shellhammer et al. discloses a method and apparatus for decoding a two-dimensional bar code symbol using a charge-coupled device (CCD) camera or a charge-modulation device (CMD) camera. The CCD/CMD camera takes pictures of the symbol and the picture is converted into digital data. The location and orientation of the two-dimensional bar code symbol is determined and verified. Defects and damages on the symbol are detected and corrected. The symbol is scanned to read the codewords of the two-dimensional bar code symbol.

U.S. Patent No. 5,296,690 to Chandler et al. discloses a bar code reader which includes an image capture means for storing a two dimensional image in memory, which stored image may include a bar code symbol within the field of view of the image. The bar code reader further includes method and apparatus for determining the location and orientation of the bar code symbol within the field of view of said image, and then filtering the located and oriented bar code symbol along an axis perpendicular to the detected orientation. Thereafter, the filtered bar code symbol is scanned and applied to a decoder to produce a decoded bar code output.

U.S. Patent No. 5,212,390 to LeBeau et al. discloses a device which employs a laser diode and cylindrical lens to project a plane of laser at an incidence angle onto a plurality of leads. The light is simultaneously reflected from each of the plurality of leads. The light that is simultaneously reflected from each lead is detected by an image sensor. A digital computer computes the cotangent function of the incidence angle to detect an amount of displacement of at least one of the plurality of leads.

U.S. Patent No. 5,192,856 to Schaham discloses in Fig. 1 a hand-held imaging device for reading and interpreting bar codes which illuminates the bar code with a fixed elliptical light beam (produced by an LED and collimating and cylindrical lens), and images the reflected beam onto a linear CCD array which is aligned with the light beam. The black and white bar information is detected by the electronically scanned elements of a linear CCD array. The limited operational range, determined by the optical system depth of focus, is enhanced significantly to a useful operational range by automatically focusing the image of the bar code on the CCD array.

U.S. Patent No. 5,136,145 to Karney discloses a symbol reader that uses a dynamic random access memory as a detector element and a gradient refractive index material as the lens to capture a symbol image. The rod shaped lens passes through an opaque cover and confronts the array of memory elements in the memory. The cover is glued to a memory device package. The PN junctions of the random access memory are activated by light reflected from a symbol and appear as data when the random access memory is read out. The light can be provided by light emitting diodes positioned adjacent to the memory package and in a handheld wand that includes a light reflecting shield in which the symbol is positioned for reading. The wand is positioned over the symbol and a read button is depressed. A computer monitoring the read button activates the light emitting diodes and then reads out the contents of the random access memory, unscrambles the data, signals the user that the symbol has been captured and then outputs the symbol image.

U.S. Patent No. 4,979,815 to Tsikos discloses a range imaging system, and a method for calibrating such a system which are based on the principles of projective geometry. The system comprises four subsystems: (1) a laser and a cylindrical lens or vibrating mirror for producing a

planar beam of light; (2) an electronic camera equipped with a lens and an appropriate interference filter; (3) an electronic circuit for height (depth) measurements and video image generation; and (4) a scanning mechanism for moving the object with respect to the light beam and the camera so as to scan an area of the object surface. The system is calibrated by determining the position in the electronic image of the object surface at three different heights. The range image is generated from these three known heights from either a previously determined look-up table, or from a calculation based on the invariance of the cross-ratio, a well known ratio from projective geometry.

U.S. Patent No. 4,900,907 to Matusima et al. discloses a handheld reader for reading optical information such as a bar code contains a reading sensor. An image of the optical information is imaged by light produced by a pair of LEDs and reflected from the optical information, via a reflecting mirror, a lens and a diaphram member, onto the reading sensor so that the image is converted into an electric signal. The pair of LEDs are disposed on both sides of the image sensor so that the images thereof are imaged near the optical information by light from the LEDs through the diaphram member, the lens and the reflecting mirror. The LEDs and reading sensor are controlled so that the LEDs are disabled from emitting light while the reading sensor performs the reading operation of the optical information.

U.S. Patent No. 4,826,299 to Powell discloses a lens which has the appearance of a prism with a relatively sharp radius at the apex. This lens finds an application in expanding a laser beam in one direction only.

U.S. Patent No. 4,687,325 to Corby, Jr. discloses a three-dimensional range camera system which measures distance from a reference plane to many remote points on the surface of an object. The set of points at which range is measured lie along a straight line (N points) or are distributed over a rectangular plane (MxN points). The system is comprised of a pattern generator to produce a 1xN array of time/space coded light rays, optionally a means such as a rotating mirror to sweep the coded light rays orthogonally by steps, a linear array camera to image subsets of the light rays incident on the object surface, and a high speed range processor to determine depth by analyzing one-dimensional scan signals. The range camera output is a one-dimensional profile or a two-dimensional area range map, typically for inspection and robotic vision applications.

U.S. Patent No. 4,570,057 to Chadima, Jr. et al. discloses a hand-held bar code reader unit with improved focusing and illumination structure.

U.S. Patent No. 3,914,596 to Finkel et al. discloses an industrial automation locating and tracking system which utilizes light having a particular signature imposed thereon. This light is directed toward the general area of a moving object that is to be located and tracked. Each such moving object in the system has a retroreflective element mounted thereon. When the object enters the searching beam of light, the light is reflected back towards the source where it is focused on a position-sensitive detector. The output signal from the position-sensitive detector is then utilized to generate a tracking signal in order to move the support upon which the light source and position-sensitive detector are mounted synchronously with the moving object.

U.S. Patent No. 3,901,597 to White discloses a laser distance measuring device. When a diffusely reflecting surface, such as the kind ordinarily encountered on the most physical objects, is located in the focal saddle of a lens, the combination produces reflection that has spatial

coherence characteristics similar to those obtained from a specular surface. Such a combination can be employed in conjunction with a conventional mirror to provide a low-Q Fabry-Perot resonant cavity. A high gain laser medium can produce oscillation with such a low-Q resonator. When the diffuse surface is outside the lens focal saddle the cavity Q is too low and laser action will not occur. As the focal saddle is advanced toward the surface, the cavity Q will increase and the onset of laser oscillation will signal contact between the focal saddle and the surface. This contact position is repeatable to high precision and is therefore a useful distance measurement. In one alternative embodiment the active laser medium is not contained withi the low-Q cavity but instead the low-Q cavity is optically coupled to a conventional laser and its optical length modulated at a convenient frequency. If the laser output is examined for modulation components at the cavity modulation frequency, contact between the focal saddle and the diffuse surface can be established by their presence. In a second alternative embodiment the low-Q cavity includes a quarter-wave plate and is optically coupled to a dual polarization laser having greater than critical adjacent mode coupling. Such a laser will oscillate in only one mode at a time but two orthogonal polarization states are permitted. When the low-Q cavity is operative, that is, when the diffuse surface is inside the lens focal saddle, moving the surface relative to the lens will cause the laser polarization state to flip for each quarter wave length of motion. Thus if the laser polarization state is monitored, entry of the surface into the focal saddle can be sensed by the onset of polarization flipping and motion inside the focal saddle can be established by counting the number of flips.

WIPO Publication No. WO 01/2028 A1 by Accu-sort Systems, Inc., discloses a system for scanning objects having a linear array sensor, adapted to detect light input signals. A lens is optically connected to the linear array sensor, and is adapted to receive and transmit an optical image located in a field of view along a lens axis to the linear array sensor. A light source which generates an illumination stripe in general linear alignment with the lens axis is provided. A cylindrical lens is positioned between the light source and an object to be scanned. The cylindrical lens adapted to collect, transmit and focus light from the light source to form the illumination stripe.

WIPO Publication No. WO 01/71419 A2 by Accu-sort Systems, Inc., discloses a scanning system which utilizes a randomly addressable image sensor which is selectively positioned at the Scheimpflug angle in the image plane in order to detect focused light reflected from an object. Light reflected from the object is focused onto the sensor through an objective lens. Since the sensor is mounted at the Scheimpflug angle, each strip within the depth of field of the object plane has corresponding pixels on the sensors which are in focus.

U.S. Provisional Application No. 60/190,273 by Chaleff et al. publishes as WIPO International Publication No. WO 01/72028 A1, discloses an optical scanning system containing a coplanar camera utilizing a LED array light source and a linear CCD sensor array.

WIPO Publication No. WO 99/64980 by Symbol Technologies, Inc. discloses an imaging engine and signal processing devices and methods for reading various kinds of optical codes. The compact structure (54") may include a two-dimensional image sensor, apparatus for focusing images at different focal disclosures, a laser-beam type aiming system, a hi-low beam illumination system employing an array of LEDs on lenslet plate (50), and related signal processing circuits.

The webpage for the "AV3700 Coplanar Illumination Option" by Accu-Sort Systems, Inc.

describes coplanar lighting technology that concentrates critical light on the target surface in the linear read area. This concentrated illumination feature allows high-speed, high-resolution image capture using a low-power LED light source. Coplanar LED illumination eliminates the mounting angle between the line of sight of the camera and the light source. This maximizes the return light and allows for a lower intensity light source.

The weblink for the Intevac New LIVAR Imagery system (http:www.intevac.com/livar_imagery/livar_imagery.html) exhibits the Laser ILluminated Viewing and Ranging (LIVAR) system which is designed for range-gated imaging in the 1.5um band.

The Intevac product brochure for the Model 120 LIVAR Short Wave IR Gated Camera describes a range-gated, laser-illuminated, two-dimensional imaging system that operates in the "eye-safe" wavelength band.

The product brochure for the Imageteam 4410ESD Hand Held 2D Image Reader describes a high performance 2-D imager capable of reading high density linear (1D), stacked (PDF417), and matrix (2D) codes, designed specifically for the stringent requirements found in clean room assembly of sensitive electronic components. With a clean room rating of 100, the ESD-resistant labeling, low particulation and contamination plastics, and ESD-resistance cables, the IT4410ESD readers are suitable for ESD-sensitive and clean room environments.

The press release for the Datalogic Lynx describes a hand-held 2D imager that, using a matricial CCD sensor and LED-based flood-type illumination, allows omnidirectional reading of the most common 1D symbologies as well as a wide variety of 2D and stacked codes.

The StockerYale Product Brochure for the Lasiris™ SNF Laser describes Lasiris™ SNF beam shaping optics which transforms the familiar laser dot into different shapes and sizes. For example, a straight line can be projected by allowing one dimension of light to fan out while maintaining tight control over the other, resulting in a sheet-of light. This laser system incorporates an optical line generator that eliminates gaussian distribution of the light.

The product brochure for the "Imageteam 3800PDF Hand Held Linear Imager for PDF417" describes a high performance, hand held bar code scanner that uses linear imaging and LED-based illumination technology and a VLD to produce a bright, sharp aiming line. Each decoded output scanner has the capability to connect as a keyboard wedge, use the serial port, output non-decoded laser compatible signals, or operate in wand emulation mode. A non decoded mode can be used with external wedge decoders and portable terminals or other devices with decoding capability.

The webpage for the NCR 7837 Linear Imaging Scanner by NCR Corporation describes a high-performance, retail scanner with 270 scans per second, better optics and improved decoding algorithms to accommodate for poorly printed, faded or damages bar codes.

The Accu-Sort Product Brochure for the AV3700 High Speed CCD Bar Code Reader describes a CCD camera that can be mounted over the belt or for side- and bottom-read applications. A new low-power, high-intensity LED-based illumination option, which can be used with the AV3700 Reader, offers the same image quality and read rate performance as the standard

sodium vapor lamps, and eliminates glare for side and bottom reading.

The DALSA, Inc. Product Brochure for the DALSA IT-P4 Image Sensors feature 4096, 6144, or 8192 elements and use proprietary technology to provide four outputs at 40MHz each. The DALSA IT-P4 Image Sensor employs buried channel CCD shift registers to maximize output speed and reduce noise. The IT-P4 sensor has a dynamic range of >1600:1 and a linear dependence on light level up to saturation. The exposure control of the IT-P4 sensor allows integration times shorter than the readout time.

The Eastman Kodak Company Product Brochure for the KAF-4202 Series Full-Frame CCD Image Sensor describes a high performance monochrome area CCD image sensor with 2032 H x 2044V photo active pixels designed for a wide range of image sensing applications in the 0.4 nm to 1.0 nm wavelength band. Typical applications include military, scientific, and industrial imaging. A 74dB dynamic range is possible operating at room temperature.

The Camera User's Manual for the DALSA Piranha CT-P4, CL-P4 High-Speed Line-Scan Camera describes a modular camera which uses the reliability, flexibility, and cost-effectiveness of high-volume interchangeable parts. Within the Piranha camera, a timing board (PB-P1-X206) generates all internal timing and a driver board (PB-P1-X139) provides bias voltages and clocks to the CCD image sensor. For enhanced dynamic range, one or two A/D board (PB-xx-D344) process the video and digitize it to 10 bits before outputting the most significant 8 bits.

The Sony Product Brochure for the ICX085AL Progressive Scan CCD Image Sensor Chip describes a 2/3-inch interline CCD solid-state image sensor with a square pixel array. Progressive scan allows all pixel signals to be output independently within approximately 1/12 second. This sensor chip features an electronic shutter with variable charge-storage time which makes it possible to realize full-frame still image without a mechanical shutter. High sensitivity and low dark current are achieved through the adoption of HAD (Hole-Accumulation Diode) sensors.

The Mitsubishi Product Brochure for the ML1XX6 series laser diodes describes a high power AlGaInP semiconductor laser which provides a stable, single transverse mode oscillation with emission wavelength of 658-nm and standard CW light output of 30mW.

The product brochure for the Imageteam 3870 Cordless Linear Imager describes a cordless bar code reader that combines a bright, sharp aiming line and high-resolution linear imaging using LED-based flood-type illumination. It scans and decodes 270 times per second and can read all common linear bar codes, plus PDF417 and MicroPDF417.

The web-based article entitled "Combo Scanners: Not Your Father's Bar Code Scanner describes handheld scanners that can read 1-D and 2-D symbologies as well as OCR fonts and typeset text.

A separate listing of the above references on PTO Form 1449 and a compact disc containing copies of these references (in .pdf format) are enclosed herewith for the convenience of the Examiner.

Respectfully submitted,

Dated: August 30, 2002

Thomas J. Perkowski
Reg. No. 33,134
Attorney for Applicants
Thomas J. Perkowski, Esq., P.C.
Soundview Plaza
1266 East Main Street
Stamford, Connecticut 06902
203-357-1950
http://www.tjpatlaw.com

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Reg. No. 33,134
Date: August 30, 2002

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SEP 0 4 2002

PATENT & TRADEMARK OFFICE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

Sheet	1	of	6

Complete If Known	
Application Number	10/067,140
Filing Date	February 4, 2002
First Name Inventor	Tsikos et al.
Group Art Unit	2876
Examiner Name	n/a
Attorney Docket Number	108-127USANB0

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	U.S. Patent Documents		Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Intn'l Class / Sub Class
		Number	Kind Code (if known)			
		6,398,112 B1		Li et al.	06/04/2002	
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Examiner Initials	Cite No.	Description
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		The web-based product information for the "Laser Illuminated Viewing and Ranging (LIVAR) System" by Intevac Corporation, http://www.intevac.com/livar_imagery/livar_imagery.html, pages 1-9.
		The web-based product information for the "Model 120 LIVAR Short Wave IR Gated Camera" by Intevac, http://www.intevac.com/photonics/products.html, 2001, pages 1-7.
		The product brochure for the "IMAGETEAM 4410ESD Hand Held 2D Image Readers for ESD-Sensitive and Clean Room Applications" by Hand Held Products, a division of WelchAllyn, 2001, pages 1-2.
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		The web-based press release for the Lynx: Datalogic Lynx Hand-Held 2D Imager by Datalogic S.p.A., http://www.datalogic.com/press/lynx_e.htm, 05/25/2001, pages 1-2.
		The product brochure for the "Lasiris SNF Laser" by StockerYale, pages 1-4.
		The web-based product information for the "NCR 7837 Linear Imaging Scanner" by NCR Corporation, www.ner.com/products/hardware/sa_7837.htm, 2001, pages 1-4.
		The product brochure for the "AV3700 High Speed CCD Bar Code Reader" by Accu-Sort Corporation, 2001, 1 page.
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		The user manual for the "Piranha CT-P4, CL-P4 High-Speed Line Scan Camera" by Dalsa, Inc., 2000, pages 1-28.

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Examiner Initials	Cite No.	Description
		The product brochure for the "ICX085AL Progressive Scan CCD Image Sensor with Square Pixel for B/W Cameras" by Sony Corporation, pages 1-20.
		The product brochure for the "ML1XX6 Series Optical Information Systems" by Mitsubishi Electric, 1999, pages 1-4.
		The web-based publication entitled "Combo Scanners: Not Your Father's Bar Code Scanner" by IDSystems, Navas, Editor at Large, http://www.idsystems.com/reader/1998_08/com0898.htm, 1998, pages 1-5.
		The web-based publication entitled "3-D Sensing" by Papadoupoulos, http://perso.club-internet.fr/dpo/numeerisation 3d, 2001, pages 1-12.

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		Office	Number	Kind Code (if known)				
		PCT	WO 01/72028 A1		Accu-Sort Systems, Inc.; Telford PA	09/27/2001	H04N 1/028	
		PCT	WO 01/71419 A2		Kurt Hecht, 1474 Old York Rd., Hartsville PA	09/27/2001	G03B	
		US	60/190,273		Thomas J. Brobst	05/29/2001		
		US	WO 99/64980		Symbol Technologies, 1 Symbol Plaza,Holtsville NY	12/16/1999	G06K 7/10	

EXAMINER **DATE CONSIDERED**

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance not considered. Include copy of this form with next communication to applicant.

(INFORMATION DISCLOSURE STATEMENT – SECTION 9 PTO-1449)